M&G No. 163.1453USI1

FABRIC TREATMENT COMPOSITIONS AND METHODS FOR TREATING FABRIC IN A DRYER

Cross Reference To Related Application

This is a continuation-in-part of U.S. Application Serial No. 10/120,891 that was filed with the United States Patent and Trademark Office on April 10, 2002. The entire disclosure of U.S. Application Serial No. 10/120,891 is incorporated herein by reference.

Field of the Invention

The invention relates to fabric treatment compositions and methods for treating fabric in a dryer. In particular, the invention provides for the dispensing of a fabric treatment agent in a dryer during a drying operation. The fabric treatment agent can be applied to impart desired beneficial properties to the fabric. The fabric treatment agent can transfer from the fabric treatment composition to wet fabric in a dryer as a result of a water solubility transfer mechanism.

Background of the Invention

Several types of dryer fabric softeners have been available. One type of dryer fabric softener is available as a dryer sheet. The dryer sheet is placed in the dryer along with wet laundry. The sheet is often a nonwoven fabric containing a solid composition that includes a fabric softener and a fragrance. During the drying cycle, the temperature increases as the laundry dries, causing the fabric softener to melt and transfer from the nonwoven sheet to the laundry. Dryer sheets are generally provided for a single use. If the dryer sheet becomes entangled with an article of laundry, excessive deposition onto that piece of laundry may result in "spotting." Spotting is the condition where concentrated fabric softener causes a dark spot on a laundry item. For certain dryer sheet products, it is believed that dispensing of the fabric softener is primarily caused by the heat of the dryer melting the fabric softener on the dryer sheet.

It is believed that this mostly takes place near the end of the drying cycle when the temperature within the dryer increases.

Dryer sheets containing fabric softeners are described by U.S. Patent No. 3,442,692 to Gaiser; U.S. Patent No. 3,686,025 to Morton; U.S. Patent No. 4,834,895 to Cook et al.; U.S. Patent No. 5,041,230 to Borcher, Sr. et al.; and U.S. Patent No. 5,145,595 to Morris et al.

Another type of dryer fabric softener is available as a pouch containing a fabric softener composition. The pouch can be attached to the dryer drum. During the drying cycle, the increase in temperature can melt a portion of the composition inside the pouch. The melted composition then passes through the pouch and transfers to the laundry. The pouch type dryer fabric softener can be available for multiple uses. An example of the pouch type dryer fabric softener was available under the name "Free 'N Soft" from Economics Laboratory of St. Paul, Minnesota. Examples of pouch type dryer fabric softeners are disclosed by U.S. Patent No. 3,870,145 to Mizuno; U.S. Patent No. 3,967,008 to Mizuno et al.; and U.S. Patent No. 4,098,937 to Mizuno et al.

Additional fabric softener compositions are disclosed by U.S. Patent No. 3,972,131 to Rudy et al. and U.S. Patent No. 4,035,307 to Fry et al.

Summary

A fabric treatment composition is provided according to the invention. The fabric treatment composition includes a fabric treatment agent and a carrier component for containing the fabric treatment agent in a solid form during operation conditions in a dryer. The fabric treatment composition is constructed for transferring the composition to wet fabric as a result of solubilizing the fabric treatment composition by contacting the fabric treatment composition with the wet fabric during a drying operation in a dryer.

The fabric treatment agent can include at least one of softening agents, anti-static agents, anti-wrinkling agents, dye transfer inhibition/color protection agents, odor removal/odor capturing agents, soil shielding/soil releasing agents, ultraviolet

light protection agents, fragrances, sanitizing agents, disinfecting agents, water repellency agents, insect repellency agents, anti-pilling agents, souring agents, mildew removing agents, allergicide agents, and mixtures thereof. The carrier component can include at least one of ethylene bisamides, primary alkylamides, alkanolamides, polyamides, alcohols containing at least 12 carbon atoms, alkoxylated alcohols containing at least 12 carbon atoms, carboxylic acids containing at least about 12 carbon atoms, derivatives thereof, and mixtures thereof.

The composition can be provided in a form that provides for multiple use applications, and the composition can be provided in the form that provides for single use applications. The composition can be provided in the form of a block for attachment to an interior wall of a dryer, in the form of a ball for free placement within a dryer, and in the form of a pellet, a tablet, or molded unit. In addition, the composition can be provided as a laminate to a fabric to provide a dryer sheet.

A method for treating fabric in a dryer is provided according to the invention. The method includes steps of allowing fabric containing free water to contact a fabric treatment composition inside a dryer during a drying operation, and transferring the fabric treatment agent from the fabric treatment composition to the fabric as a result of solubilizing the fabric treatment agent with the free water in the fabric. The step of transferring the fabric treatment composition can substantially end when the fabric dries sufficiently to lose the free water. In addition, the rate of transfer of the fabric treatment composition can decrease as the fabric dries during the drying operation.

Brief Description of the Drawings

Figure 1a is a side view of a solid product having a half-cylindrical narrow shape and a high dome;

Figure 1b is an end view of the solid product shown in Figure 1a;

Figure 2a is a side view of a solid product having a half-cylindrical narrow shape and a high dome with rounded top edges;

Figure 2b is an end view of the solid product shown in Figure 2a;

Figure 3a is a side view of a solid product having a half-cylindrical wide shape and a low dome;

Figure 3b is an end view of the solid product shown in Figure 3a;

Figure 4a is a side view of a solid product having a half-cylindrical wide shape and a low dome with rounded top edges;

Figure 4b is an end view of the solid product shown in Figure 4a;

Figure 5 is a graph showing the average dose per load as a function of the number of dryer loads according to Example 7;

Figure 6 is a graph showing the dose per drying cycle according to Example 8;

Figure 7 is a graph showing softness preference units for various tested products according to Example 9;

Figure 8 is a graph showing softness preference units for various tested products according to Example 10;

Figure 9 is a graph showing percent static reduction for a group of tested products according to Example 11;

Figure 10 is a graph showing percent static reduction for tested products according to Example 12;

Figure 11 is a graph showing charge on individual articles according to Example 13; and

Figure 12 is a graph showing whiteness retention properties for tested products as a function of the number of dryer cycles according to Example 14.

Detailed Description of the Invention

Fabric treatment compositions for use in a dryer are provided by the invention. A fabric treatment composition according to the invention can be referred to more simply as a "treatment composition" or as a "composition," and can be provided in a form or shape that allows for delivery of a fabric treatment agent to fabric during the drying operation of a dryer. In general, the fabric treatment composition can remain a solid under the operating temperatures of the dryer. In

addition, the fabric treatment composition can be provided as a single use or as a multiple use construction for dispensing a fabric treatment agent. It should be understood that "single use" and "multiple use" refers to the number of drying cycles in which the fabric treatment composition can be used and release an effective amount of a fabric treatment agent to fabric that is being dried during the operation of a dryer. The fabric treatment compositions can be provided for use in various types of dryers including those encountered in industrial fabric drying operations and in residential or home dryers.

The fabric treatment composition includes a fabric treatment agent and a carrier for containing the fabric treatment agent. The fabric treatment agent is the chemical component or components of the composition that imparts the desired beneficial properties to the fabric. The carrier is provided for containing and holding the fabric treatment agent in a desired shape and for facilitating transfer of the fabric treatment agent to the fabric during the drying operation. The carrier can be characterized as a dispensing carrier or a non-dispensing carrier depending upon whether the carrier transfers to the fabric. In the case of a dispensing carrier, it is expected that both the carrier and the fabric treatment agent transfer to the fabric. In the case of a non-dispensing carrier, it is expected that the fabric treatment agent transfers to the fabric without transfer of the carrier. It should be understood that a dispensing carrier can exhibit a wide range of dispensing properties. That is, large amounts or very little of the dispensing carrier can transfer to the fabric. In the context of the description of the invention, it should be understood that, unless specifically indicated, the transfer of the fabric treatment agent can include or not include transfer of the carrier. In addition, it should be understood that other components that may be present in the fabric treatment composition can be transferred along with the fabric treatment agent. In addition, multiple fabric treatment agents can transfer when they are present in the fabric treatment composition.

It is believed that the fabric treatment agent and/or the fabric treatment composition will transfer to wet fabric during a drying operation as a result of contact between the wet fabric and the fabric treatment composition. It is believed that

transfer occurs as a result of solubilizing the fabric treatment agent and/or the fabric treatment composition. The solubilized fabric treatment agent and/or fabric treatment composition transfers to the wet fabric as a result of contacting the wet fabric. As the fabric dries, it is expected that the rate of transfer decreases. It is believed that the primary mechanism for transfer of the fabric treatment agent and/or the fabric treatment composition is solubility as a result of the presence of water in the fabric during a drying operation. The temperature within the dryer may assist in solubilizing the fabric treatment agent and/or the fabric treatment composition. In addition, it is expected that in certain circumstances some amount of the fabric treatment agent and/or the fabric treatment composition may rub off onto the fabric and it is possible that a certain amount of the fabric treatment agent and/or the fabric treatment composition may transfer to the fabric by a mechanism other than by solubilizing onto the wet fabric. Nevertheless, it is expected that the water in the fabric will facilitate and will be primarily responsible for transferring the fabric treatment agent and/or the fabric treatment composition to the fabric. The Applicants' base this theory on their observation that running dry towels in a dryer in the presence of an exemplary fabric treatment composition resulted in negligible transfer of the fabric treatment composition to the dry towels.

It is expected that the fabric treatment composition will generally resist melting during operating conditions in the dyer so that melt transfer of the fabric treatment composition to the fabric will be relatively small, if it exists at all, and will likely not be a primary mechanism for transfer to the fabric. Once the fabric inside the dryer is considered dry, and there is no remaining free water to solubilize the fabric treatment agent and/or the fabric treatment composition, and it is expected that there will be substantially no transfer of the fabric treatment agent and/or the fabric treatment composition to the fabric by a solubility mechanism. It is possible that there may be some transfer as a result of a rubbing or friction between the fabric and the fabric treatment composition depending upon the components selected for the fabric treatment composition and the operating temperature in the dryer.

Fabrics that can be processed according to the invention include any textile or fabric material that can be processed in a dryer for the removal of water. Fabrics are often referred to as laundry in the case of industrial and domestic (or residential) laundry operations. While the invention is characterized in the context of treating "fabric," it should be understood that items or articles that include fabric can similarly be treated. In addition, it should be understood that items such as towels, sheets, and clothing are often referred to as laundry and are types of fabrics. Additional laundry items that can be treated by the fabric treatment composition include athletic shoes, accessories, stuffed animals, brushes, mats, hats, gloves, outerwear, tarpaulins, tents, and curtains.

U.S. Application Serial No. 10/120,891 that was filed with the United States Patent and Trademark Office on April 10, 2002 describes, among other things, fabric softener compositions and methods for manufacturing and using fabric softener compositions. The fabric softener compositions according to U.S. Application Serial No. 10/120,891 can be used in a dryer for the delivery of a fabric softener agent, and other components, to fabric in a dryer. U.S. Application Serial No. 10/120,891 includes a description of a fabric softener composition that includes a carrier that can be characterized as a dispensing carrier, and a fabric softener agent that can be considered a fabric treatment agent where the benefit of the fabric softener agent is the softening of fabric. The entire disclosure of U.S. Application Serial No. 10/120,891 is incorporated herein by reference.

The dryers in which the fabric softener composition according to the invention can be used include any type of dryer that uses heat and/or agitation and/or air flow to remove water from the laundry. An exemplary dryer includes a tumble-type dryer where the laundry is provided within a rotating drum that causes the laundry to tumble during the operation of the dryer. Tumble-type dryers are commonly found in residences and in commercial and industrial laundry operations.

The fabric treatment composition is provided for releasing an effective amount of the fabric treatment agent to the laundry during a drying cycle in a dryer to provide the desired beneficial property or properties to the fabric or item or article

being treated. It is believed that the effective amount of the fabric treatment agent is transferred primarily as a result of solubility by contacting the wet laundry and the fabric treatment composition in the dryer, and that as the fabric becomes dryer and there is less free water in the fabric, the rate of transfer as a result of solubilizing the fabric treatment agent and/or fabric treatment composition will decrease. It is expected that the transfer can be essentially stopped once the fabric becomes sufficiently dry. The exact mechanism of the transfer is not precisely known, but it is believed that the transfer is likely the result of the wet laundry solubilizing a portion of the fabric treatment composition and/or a rubbing off of a portion of the fabric treatment composition onto the wet laundry as the wet laundry contacts the fabric treatment composition during the tumbling operation in a dryer. As the laundry dries, it is expected that less of the fabric treatment agent and/or the fabric treatment composition will transfer to the laundry. It should be understood that there may be relatively small or amounts of transfer after the fabric dries, but it is expected that this amount of transfer, if it occurs at all is insufficient to impart the desired beneficial properties to the fabric. Because of this decrease of transfer, the fabric treatment composition can be characterized as a "smart composition." By dispensing by moisture control, it is possible to avoid overdosing that may result if the composition were to transfer by melting. This is in contrast to the expected operation of certain commercial dryer sheets that are believed to be temperature activated. In the case of certain temperature activated dryer sheets, it is expected that a softening agent is released when the laundry is relatively dry and the temperature within the dryer achieves a certain temperature. In addition, the transfer continues until the softening agent is completely released from the dryer sheet or until the drying operation is interrupted.

While the inventors believe that the fabric treatment agent and/or the fabric treatment composition transfers to fabric as a result of solubility in water, it should be understood that this is the Applicants' theory and other mechanisms may explain the transfer. Nevertheless, it should be recognized that the Applicants' observe a rate of transfer that decreases as the fabric dries.

The Fabric Treatment Composition

The fabric treatment composition includes a fabric treatment agent or component and a carrier component. The fabric treatment agent is generally responsible for providing or imparting the various beneficial properties to the fabric. The carrier component mixes with the fabric treatment agent and helps the fabric treatment agent resist transfer to fabric or laundry by melting during the drying operation. The carrier component can be chosen so that the fabric treatment composition exhibits a melting point or softening point that is above the operating temperature of the dryer. It is expected that industrial or commercial dryers operate at incoming air temperatures that are typically provided in the range of between about 190°F and about 240°F, and home or residential dryers often operate at incoming air temperatures of between about 120°F and about 160°F. It should be understood that the temperature of the home or residential dryer can often be changed depending upon the item being dried. It is sometimes desirable to run the home dryer at room temperature (about 50°F to about 60°F) in situations where, for example, fluff is desired. As a result, the fabric treatment composition can be provided having a melting temperature or softening temperature that is relatively low but that exceeds the intended operating temperature of the dryer. In the case of a fabric treatment composition intended to be used in a commercial dryer, the melting temperature and softening temperature can be provided in excess of 240°F. In the case of a fabric treatment composition intended to be used in a home or residential dryer, the fabric treatment composition can be provided having a melting temperature or softening temperature in excess of 160°F. It should be understood that if the fabric treatment composition is intended to be used in a home or residential dryer that is intended to be operated on a fluff cycle, the melting temperature or softening temperature can be provided in excess of 70°F. In many applications, it is expected that the melting temperature of the fabric treatment composition will be above about 90°C. The melting temperature of the fabric treatment composition can be above about 95°C, above about 100°C, above about 110°C, or above about 120°C. In addition, the

melting temperature of the fabric softener composition can be below about 200°C. The melting temperature of the fabric treatment composition refers to the temperature at which the composition begins to flow under its own weight. As the fabric treatment composition reaches its melting point, one will observe the composition undergoing a transfer from a solid discrete mass to a flowable liquid. Although a differential scanning calorimeter (DSC) measurement of the composition may reveal that certain portions or phases of the composition may exhibit melting at temperatures that are within the operating temperatures of a dryer, it should be understood that what is meant by the melting temperature of the composition is not the melting temperature of certain portions or phases within the composition, but the melting temperature of the composition as demonstrated by the composition being visibly observed as a flowable liquid. It is expected that the fabric treatment composition may be provided as a solid mixture including multiple phases or as a solid solution including a single phase. The softening temperature of the composition refers to the temperature at which the solid mass becomes easily deformable. For many exemplary compositions according to the invention, it is expected that the softening temperature will be a few degrees below the melting temperature.

The fabric treatment component can include any component that, when melt mixed with the carrier component, provides a fabric treatment composition that resists melting during operation of the dryer, and that provides desired beneficial properties to fabric or laundry as a result of its presence when used during the operation of drying wet laundry in a dryer. The fabric treatment agent can be applied to fabric in a dryer to impart various beneficial properties to the fabric. Exemplary beneficial properties include softening, anti-static, anti-wrinkling, dye transfer inhibition/color protection, odor removal/odor capturing, soil shielding/soil releasing, ultraviolet light protection, fragrance, sanitizing, disinfecting, water repellency, mosquito repellency, anti-pilling, souring, mildew removing, allergicide properties, and combinations thereof.

The fabric treatment agent can include a fabric softener agent or component when it is desired to impart fabric softening properties to the fabric.

Exemplary fabric softener agents include those described in U.S. Application Serial No. 10/120,891 that is incorporated herein by reference. Exemplary components that can be used as the fabric softener agent includes those fabric softeners that are commonly used in the laundry drying industry to provide fabric softening properties.

A general type of fabric softener component that can be used according to the invention can be referred to as quaternary ammonium compounds. Exemplary quaternary ammonium compounds include alkylated quaternary ammonium compounds, ring or cyclic quaternary ammonium compounds, aromatic quaternary ammonium compounds, diquaternary ammonium compounds, alkoxylated quaternary ammonium compounds, amidoamine quaternary ammonium compounds, ester quaternary ammonium compounds, and mixtures thereof.

Exemplary alkylated quaternary ammonium compounds include ammonium compounds having an alkyl group containing between 6 and 24 carbon atoms. Exemplary alkylated quaternary ammonium compounds include monoalkyl trimethyl quaternary ammonium compounds, monomethyl trialkyl quaternary ammonium compounds, and dialkyl dimethyl quaternary ammonium compounds. Examples of the alkylated quaternary ammonium compounds are available commercially under the names Adogen™, Arosurf®, Variquat®, and Varisoft®. The alkyl group can be a C_8-C_{22} group or a C_8-C_{18} group or a C_{12}-C_{22} group that is aliphatic and saturated or unsaturated or straight or branched, an alkyl group, a benzyl group, an alkyl ether propyl group, hydrogenated-tallow group, coco group, stearyl group, palmityl group, and soya group. Exemplary ring or cyclic quaternary ammonium compounds include imidazolinium quaternary ammonium compounds and are available under the name Varisoft®. Exemplary imidazolinium quaternary ammonium compounds include methyl-1hydr. tallow amido ethyl-2-hydr. tallow imidazolinium-methyl sulfate, methyl-1-tallow amido ethyl-2-tallow imidazolinium-methyl sulfate, methyl-1-oleyl amido ethyl-2-oleyl imidazolinium-methyl sulfate, and 1-ethylene bis (2-tallow, 1-methyl, imidazolinium-methyl sulfate). Exemplary aromatic quaternary ammonium compounds include those compounds that have at least one benzene ring in the structure. Exemplary aromatic quaternary ammonium compounds include

dimethyl alkyl benzyl quaternary ammonium compounds, monomethyl dialkyl benzyl quaternary ammonium compounds, trimethyl benzyl quaternary ammonium compounds, and trialkyl benzyl quaternary ammonium compounds. The alkyl group can contain between about 6 and about 24 carbon atoms, and can contain between about 10 and about 18 carbon atoms, and can be a stearyl group or a hydrogenated tallow group. Exemplary aromatic quaternary ammonium compounds are available under the names Variquat® and Varisoft®. The aromatic quaternary ammonium compounds can include multiple benzyl groups. Diquaternary ammonium compounds include those compounds that have at least two quaternary ammonium groups. An exemplary diquaternary ammonium compound is N-tallow pentamethyl propane diammonium dichloride and is available under the name Adogen 477. Exemplary alkoxylated quaternary ammonium compounds include methyldialkoxy alkyl quaternary ammonium compounds, trialkoxy alkyl quaternary ammonium compounds, trialkoxy methyl quaternary ammonium compounds, dimethyl alkoxy alkyl quaternary ammonium compounds, and trimethyl alkoxy quaternary ammonium compounds. The alkyl group can contain between about 6 and about 24 carbon atoms and the alkoxy groups can contain between about 1 and about 50 alkoxy groups units wherein each alkoxy unit contains between about 2 and about 3 carbon atoms. Exemplary alkoxylated quaternary ammonium compounds are available under the names Variquat®, Varstat®, and Variquat®. Exemplary amidoamine quaternary ammonium compounds include diamidoamine quaternary ammonium compounds. Exemplary diamidoamine quaternary ammonium compounds are available under the name Varisoft®. Exemplary amidoamine quaternary ammonium compounds that can be used according to the invention are methyl-bis(tallow amidoethyl)-2-hydroxyethyl ammonium methyl sulfate, methyl bis (oleylamidoethyl)-2-hydroxyethyl ammonium methyl sulfate, and methyl bis (hydr.tallowamidoethyl)-2-hydroxyethyl ammonium methyl sulfate. Exemplary ester quaternary compounds are available under the name Stephantex™.

The quaternary ammonium compounds can include any counter ion that allows the component to be used in a manner that imparts fabric-softening properties

according to the invention. Exemplary counter ions include chloride, methyl sulfate, ethyl sulfate, and sulfate.

Quaternary ammonium compounds that can be used as fabric softener components can be available as relatively pure or concentrated quaternary ammonium compounds or they can be provided in a medium. Exemplary mediums include solvents and/or surfactants. When the quaternary ammonium compounds are provided in a medium, they can be provided in the medium in an amount of between at least about 50 wt.%, or between about 50 wt.% and about 99 wt.%, or between about 70 wt.% and about 95 wt.%, or between about 75 wt.% and about 90 wt.%. Exemplary mediums for the quaternary ammonium compounds include alcohols, glycols, nonionics, fatty alcohols, fatty acids, triglycerides, and solid esters. An exemplary alcohol that can be used is isopropanol. Exemplary glycols that can be used include hexylene glycol and propylene glycol. Exemplary nonionics include ethoxylated alcohols. Exemplary fatty alcohols include stearyl alcohols. Exemplary fatty acids include hard tallow acids and stearic acid. Exemplary triglycerides include hydrogenated tallow. Exemplary solid esters include stearyl stearate.

The Applicants' discovered that certain fabric softener agents can be incorporated into the fabric treatment composition that exhibit reduced yellowing. The reduction in yellowing can be observed in either or both of the solid fabric treatment composition and the fabrics that are treated. It is expected that consumers will prefer a fabric treatment composition that retains its original color (such as white) and resists yellowing after several uses. In addition, it is desirable to provide a fabric softening agent that does not cause significant yellowing of fabrics that are repeatedly washed and dried.

When the fabric treatment composition includes a softening agent for providing softening properties, it is generally desirable for the fabric that is dried to remain white even after multiple drying cycles. That is, it is desirable that the fabric treatment composition not generate too much yellowing after repeated cycles of drying in the presence of the fabric treatment composition. Whiteness retention can be measured according to a whiteness index using, for example, a Hunter Lab instrument.

In general, it is desirable for the fabric treated, such as 12 terry cloth towels, to exhibit a whiteness retention of at least 90% after 10 drying cycles. The whiteness retention can be greater than 95% after 10 drying cycles.

It is generally desirable for fabric treated in a dryer using the fabric treatment composition to possess a softness preference that is at least comparable to the softness preference exhibited by commercially available dryer sheets such as Bounce® and Downy® from Proctor & Gamble. The softness preference is derived from a panel test with one-on-one comparisons of fabric (such as towels) treated with the fabric treatment composition according to the invention or with a commercially available dryer sheet. In general, it is desirable for the softness preference resulting from the fabric treatment composition to be superior to the softness preference exhibited by commercially available dryer sheets.

The fabric treatment composition, when it includes an anti-static agent, can generate a percent static reduction of at least about 50% when compared with fabric that is not subjected to treatment. The percent static reduction can be greater than 70% and it can be greater than 80%. The test for static reduction can be carried out on 12 cotton terry towels and/or 12 50/50 poly/cotton pillowcases. It has been observed that fabric treated using the fabric treatment composition according to the invention exhibit more constant percent static reduction compared with commercially available dryer sheets.

The fabric treatment agent can include anti-static agents such as those commonly used in the laundry drying industry to provide anti-static properties. Exemplary anti-static agents include those quaternary compounds mentioned in the context of softening agents. Accordingly, a benefit of using softening agents containing quaternary groups is that they may additionally provide anti-static properties.

The fabric treatment agent can include anti-wrinkling agents to provide anti-wrinkling properties. Anti-wrinkling agents can include siloxane or silicone containing compounds. In addition, anti-wrinkling agents can include quaternary ammonium compounds. Exemplary anti-wrinkling agents include

polydimethylsiloxane diquaternary ammonium that is available under the name Rewoquat SQ24 from DeGussa-Goldschmidt; silicone copolyol fatty quaternary ammonium that is available under the name Lube SCI-Q from Lambert Technologies; and polydimethyl siloxane with polyoxyalkylenes under the name Tinotex CMA from CIBA.

The fabric treatment agent can include odor capturing agents. In general, odor capturing agents are believed to function by capturing or enclosing certain molecules that provide an odor. Exemplary odor capturing agents include cyclodextrins, and zinc ricinoleate.

The fabric treatment agent can include fiber protection agents that coat the fibers of fabrics to reduce or prevent disintegration and/or degradation of the fibers. Exemplary fiber protection agents include cellulosic polymers.

The fabric treatment agent can include color protection agents for coating the fibers of the fabric to reduce the tendency of dyes to escape the fabric into water. Exemplary color protection agents include quaternary ammonium compounds and surfactants. An exemplary quaternary ammonium color protection agent includes di-(nortallow carboxyethyl) hydroxyethyl methyl ammonium methylsulfate that is available under the name Varisoft WE 21 CP from DeGussa-Goldschmidt. An exemplary surfactant color protection agent is available under the name Varisoft CCS-1 from DeGussa-Goldschmidt. An exemplary cationic polymer color protection agent is available under the name Tinofix CL from CIBA. Additional color protection agents are available under the names Color Care Additive DFC 9, Thiotan TR, Nylofixan P-Liquid, Polymer VRN, Cartaretin F-4, and Cartaretin F-23 from Clariant; EXP 3973 Polymer from Alco; and Coltide from Croda.

The fabric treatment agent can include soil releasing agents that can be provided for coating the fibers of fabrics to reduce the tendency of soils to attach to the fibers. Exemplary soil releasing agents include polymers such as those available under the names Repel-O-Tex SRP6 and Repel-O-Tex PF594 from Rhodia; TexaCare 100 and TexaCare 240 from Clariant; and Sokalan HP22 from BASF.

The fabric treatment agent can include optical brightening agents that impart fluorescing compounds to the fabric. In general, fluorescing compounds have a tendency to provide a bluish tint that can be perceived as imparting a brighter color to fabric. Exemplary optical brighteners include stilbene derivatives, biphenyl derivatives, and coumarin derivatives. An exemplary biphenyl derivative is distyryl biphenyl disulfonic acid sodium salt. An exemplary stilbene derivative includes cyanuric chloride/diaminostilbene disulfonic acid sodium salt. An exemplary coumarin derivative includes diethylamino coumarin. Exemplary optical brighteners are available under the names Tinopal 5 BM-GX, Tinopal CBS-CL, Tinopal CBS-X, and Tinopal AMS-GX from CIBA.

The fabric treatment agent can include a UV protection agent to provide the fabric with enhanced UV protection. In the case of clothing, it is believed that by applying UV protection agents to the clothing, it is possible to reduce the harmful effects of ultraviolet radiation on skin provided underneath the clothing. As clothing becomes lighter in weight, UV light has a greater tendency to penetrate the clothing and the skin underneath the clothing may become sunburned. An exemplary UV protection agent includes Tinosorb FD from CIBA.

The fabric treatment agent can include an anti-pilling agent that acts on portions of the fiber that stick out or away from the fiber. Anti-pilling agents can be available as enzymes such as cellulase enzymes. Exemplary cellulase enzyme anti-pilling agents are available under the names Puradex from Genencor and Endolase and Carezyme from Novozyme.

The fabric treatment agent can include water repellency agents that can be applied to fabric to enhance water repellent properties. Exemplary water repellents include perfluoroacrylate copolymers, hydrocarbon waxes, and polysiloxanes.

The fabric treatment agent can include disinfecting and/or sanitizing agents. Exemplary sanitizing and/or disinfecting agents include quaternary ammonium compounds such as alkyl dimethylbenzyl ammonium chloride, alkyl dimethylethylbenzyl ammonium chloride, octyl decyldimethyl ammonium chloride, dioctyl dimethyl ammonium chloride, and didecyl dimethyl ammonium chloride.

The fabric treatment agent can include souring agents that neutralize residual alkaline that may be present on the fabric. The souring agents can be used to control the pH of the fabric. The souring agents can include acids such as saturated fatty acids, dicarboxylic acids, and tricarboxylic acids. Exemplary acids include those that remain solid under conditions of operation in the dryer. While it may be desirable to provide components in the fabric treatment composition that are solid during conditions of operation of the dryer, that is not necessary. It is expected that certain components may be liquid under conditions of operation in the dryer and the composition may still function as desired. Exemplary saturated fatty acids include those having 10 or more carbon atoms such as palmitic acid, stearic acid, and arachidic acid (C20). Exemplary dicarboxylic acids include oxalic acid, tartaric acid, glutaric acid, succinic acid, adipic acid, and sulfamic acid. Exemplary tricarboxylic acids include citric acid and tricarballylic acids.

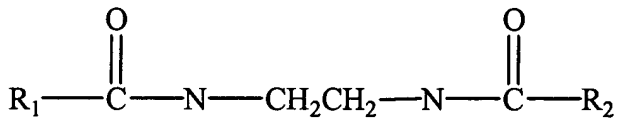
The fabric treatment agent can include insect repellents such as mosquito repellents. An exemplary insect repellent is DEET. In addition, the fabric treatment agent can include mildewcides that kill mildew and allergicides that reduce the allergic potential present on certain fabrics and/or provide germ proofing properties.

The carrier component of the fabric treatment composition can be any component that helps contain the fabric treatment component within the composition, allows the fabric treatment component to transfer to wet laundry, and provides the fabric treatment composition with a melting temperature or a softening temperature that is greater than the operating temperature of the dryer. The carrier component can be characterized as a dispensing carrier or a non-dispensing carrier depending upon whether the carrier component transfers to the wet laundry during a drying operation in a dryer. A non-dispensing carrier does not, in general, transfer to wet laundry although it allows other components in the composition to transfer to wet laundry. The dispensing carrier does transfer to wet laundry and the amount of transfer can vary depending upon the materials selected as the dispensing carrier.

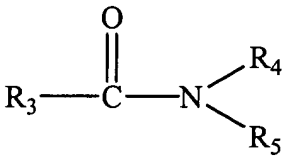
The carrier component can be any component that mixes with the fabric treatment agent and forms a fabric treatment composition having a desired shape and that allows transfer of the fabric treatment agent to wet fabric during a drying operation in a dryer. The carrier component and the fabric treatment agent can be melted, mixed, and allowed to solidify to form a desired shape. Exemplary techniques for forming the composition include injection molding, casting, solution mixing, and melt mixing. It should be understood that mixing in an extruder is a form of melt mixing that occurs generally at relatively high pressures. In general, it may be desirable for the carrier component and the fabric treatment component to be soluble in each other, and sufficiently water soluble to allow water solubility induced movement of the composition to wet fabric during a drying operation in a dryer. The fabric treatment agent can be sufficient compatible with the carrier component that is can be characterized as a plasticizer for the carrier component. The carrier component can be selected to provide the fabric treatment composition as a solid during a drying operation in a dryer. Although a differential scanning calorimeter (DSC) measurement of the composition may reveal that certain portions or phases of the composition may exhibit melting at temperatures that are within the operating temperatures of a dryer, it should be understood that what is meant by the melting temperature of the composition is not the melting temperature of certain portions or phases within the composition, but the melting temperature of the composition as demonstrated by the composition being visibly observed as a flowable liquid. It is expected that the fabric softener composition may be provided as a solid mixture including multiple phases or as a solid solution including a single phase. The softening temperature of the composition refers to the temperature at which the solid mass becomes easily deformable. For many exemplary compositions according to the invention, it is expected that the softening temperature will be a few degrees below the melting temperature.

Exemplary carrier components that can be used according to the invention include ethylene bisamides, primary alkylamides, alkanolamides, polyamides, alcohols containing at least 12 carbon atoms, alkoxylated alcohols

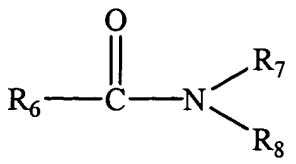
containing alkyl chain of at least 12 carbon atoms, carboxylic acids containing at least 12 carbon atoms, and derivatives thereof. Exemplary ethylene bisamides include those having the following formula:



wherein R_1 and R_2 are alkyl groups containing at least 6 carbon atoms, and can be straight or branched, saturated or unsaturated, cyclic or noncyclic, and can include ethylene oxide groups and/or propylene oxide groups. R_1 and R_2 can be C_6-C_{24} alkyl groups. R_1 and R_2 can be the same or different. Exemplary ethylene bisamides include ethylene bis-stearamide, ethylene bispalmitamide, ethylene bisoleamide, ethylene bisbehenamide, and mixtures thereof. An exemplary mixture of ethylene bisamides includes a mixture of ethylene bis-stearamide and ethylene bis-palmitamide which can be available as a 50-50 mixture. Exemplary primary alkylamides include those having the following formula:



wherein R_3 is a C_6-C_{24} alkyl group that may be straight or branched, saturated or unsaturated, cyclic or noncyclic, and R_4 and R_5 can be hydrogen or C_1-C_{24} alkyl groups that are straight or branched, saturated or unsaturated, cyclic or noncyclic. R_4 and R_5 can be the same or different. An exemplary primary alkylamide is stearamide. Exemplary alkanolamides include those having the following formula:



Wherein R_6 is a C_6-C_{24} alkyl group that may be straight or branched, saturated or unsaturated, cyclic or noncyclic. R_7 and R_8 can be the same or different. When they are different, one can be hydrogen and the other can be an alkanol group such as C_2H_4OH or C_3H_6OH. When they are the same, they can each be an alkanol group such as C_2H_4OH or C_3H_6OH. Exemplary alcohols include those having the following formula:

$$R_9 — OH$$

wherein R_9 is a C_{12} to C_{24} alkyl group that can be straight or branched, saturated or unsaturated, cyclic or noncyclic. Exemplary alcohols include stearyl alcohol and behenyl alcohol. Exemplary alkoxylated alcohols include those having the formula:

$$R_{10} — O\,(AO)_x$$

wherein R_{10} is a C_{12}-C_{24} alkyl group that is straight or branched, saturated or unsaturated, cyclic or noncyclic, and AO is an ethylene oxide or propylene oxide group, and x is a number from 1 to 100.

Exemplary polymers that can be used as the carrier component include polyalkylenes such as polyethylene, polypropylene, and random and/or block copolymers of polyethylene and polypropylene; polyesters such as polyethylene glycol and biodegradable polymers such as polylactide and polyglycolic acid; polyurethanes; polyamides; polycarbonates; polysulfones; polysiloxanes; polydienes such as polybutylene, natural rubbers, and synthetic rubbers; polyacrylates such as polymethylmethacrylate; and addition polymers such as polystyrene and

polyacrylonitrile-butadiene-styrene; mixtures of polymers; and copolymerized mixtures of polymers.

Additional components that can be included in the fabric softener composition include plasticizers, fragrances, and dyes.

Preparation of Composition

The fabric softener composition can be prepared by mixing the fabric softener component and the carrier component and any additional desired components at a temperature sufficient to melt all the components. The step of mixing can take place at a temperature in excess of about 100°C. In general, the components should not be mixed at a temperature that is so high that it harms or discolors the components of the composition. For many components of the fabric softener composition, the mixing temperature can be less that about 180°C. An exemplary range for mixing is between about 120°C and about 150°C. Once the components are sufficiently mixed, the composition is shaped to provide a desired form. The form can be provided as a solid unitary structure.

Solid Form

The fabric treatment composition can be provided in a variety of solid forms. The fabric treatment composition can be constructed in a form that allows it to provide "single use" dispensing. That is, it is expected that a single use composition will be added each time the dryer is run through a drying cycle, and the amount of fabric treatment agent in the composition will be an amount sufficient to impart the desired beneficial properties to the fabric or laundry being treated in the dryer. The fabric treatment composition can be constructed in a form that provides for "multiple uses." It should be understood that multiple uses refers to the ability to dispense sufficient amounts of the fabric treatment agent during multiple cycles in a dryer. It should be understood that multiple cycles refers to at least 2 cycles. For most multiple use compositions, it is expected that they will be capable of dispensing a sufficient amount of the fabric treatment agent for at least about 5 cycles, at least about 10

cycles, at least about 50 cycles, and at least about 80 cycles. In addition, multiple use compositions can be provided that are capable of dispensing a sufficient amount of the fabric treatment agent up to about 200 cycles, up to about 150 cycles, or up to about 100 cycles. Exemplary ranges of cycles include about 2 to about 200, about 50 to about 150, and about 80 to about 100. In industrial applications, it is expected that it may be desirable to provide between about 50 cycles and about 150 cycles. In the context of residential or home use, it is expected to be desirable to provide between about 30 cycles and about 60 cycles.

Exemplary shapes for the fabric treatment composition include blocks, pellets, sheets, and balls. It is expected that these various shapes can all provide either single use applications or multiple use applications. It is expected that the blocks and the balls will be more readily adapted for multiple uses. In the case of a ball, it is expected that the ball will be placed freely inside the dryer to contact the fabric and laundry and will be removed from the dryer along with the fabric and laundry at the end of the drying cycle. The ball can then be retrieved and reused in a subsequent drying cycle. It is expected that the block will be provided attached to structure within the dryer. Exemplary structure that the block can be attached to is a dryer fin. It should be understood that a strip can be considered a form of a block. As the wet fabric or laundry contacts an exposed surface of the fabric treatment composition, it is expected that the fabric treatment agent and/or the fabric treatment composition will solubilize and transfer to the fabric or laundry. Exemplary cradles that can be used to hold the fabric treatment composition in place in the dryer include cradles such as those disclosed in U.S. Application Serial No. 10/121,440 that was filed with the United States Patent and Trademark Office on April 10, 2002, U.S. Application Serial No. 10/411,062 that was filed with the United States Patent and Trademark Office on April 9, 2003, and U.S. Application Serial No. _____ (Atty. Docket No. 117P45USI2 and entitled "Product Dispenser and Carrier") that was filed with the United States Patent and Trademark Office on September 4, 2003. Each of these three patent applications is incorporated herein by reference in its entirety.

The Applicants' believe that the pellets and the sheets are more readily adapted for single use applications. That is, the pellets and the sheets can be placed in a dryer in contact with the wet fabric or laundry and removed after the drying operation is complete. In the case of a pellet, it is expected that the pellet may completely disintegrate as a result of it becoming solubilized in the wet fabric or laundry. It is expected that pellets can be provided as a result of extrusion. In addition, other single use shapes can be provided including tablets and relatively small units that can be prepared from other techniques including casting or molding. In the case of a dryer sheet, it is expected that the fabric treatment composition will be provided on a substrate and that the substrate will be removed at the end of the drying cycle. The substrate may or may not have any fabric treatment composition remaining thereon at the end of the drying cycle. The substrate for a dryer sheet can be any substrate that will function in forming a drying sheet including woven and nonwoven materials.

Now referring to Figures 1-4, exemplary configurations of a fabric treatment composition according to the invention are shown. Figures 1a and 1b show a fabric treatment composition having a half-cylindrical narrow shape and a high dome. An exemplary product can be characterized as having a 1.75 inch width and a 1 inch height. Figures 2a and 2b show an exemplary fabric treatment composition that can be characterized as having a half-cylindrical narrow shape and a high dome with rounded top edges. The width can be provided as 1.75 inches and the height can be provided as 1 inch. Figures 3a and 3b show an exemplary fabric treatment composition having a half-cylindrical wide shape and a low dome. The width can be 2.5 inches and the height can be 0.65 inches. Figures 4a and 4b show an exemplary fabric treatment composition having a half-cylindrical wide shape and a low dome with rounded top edges. The product can have a width of 2.5 inches and a height of 0.65 inches.

Exemplary forms include blocks or strips that can be placed within a drying machine so that a surface of the fabric softener composition is exposed to laundry during the drying operation. Exemplary forms include a rectangular block and

a rectangular strip. Additional forms include half-cylindrical shapes with the exposed surfaces and edges being curved or rounded for better dispensing. The shape of the fabric softener composition can be used to control dispensing of the fabric treatment agent. For example, it has been observed that the presence of sharp edges that contact fabric during a drying operation in a dryer may have a tendency to deliver more fabric treatment agent and/or fabric treatment composition to the fabric until the edges become worn down compared with an otherwise identical fabric treatment composition that contains curved or rounded edges. Accordingly, the shape of the fabric treatment composition can be used to deliver more of a certain fabric treatment agent to fabric during early stages. For example, when a fabric treatment composition is new, it may be desirable to include water repellent agents in the edge portions of the fabric treatment composition with the expectation that fabric treated by new fabric treatment composition will receive a higher dose of water repellent agents. Accordingly, the fabric treatment composition can include multiple fabric treatment agents provided at different locations within the fabric treatment composition as desired to control the stage at which certain fabric treatment agents become released.

The fabric treatment composition can be placed on an interior wall of a dryer so that the fabric treatment composition contacts the laundry or items inside the dryer that are being dried. The interior wall can be a fin of the dryer or it can be some other wall. For example, the interior wall can be a door, an end wall, and a glass window.

The fabric treatment composition can have a variety of sizes. The sizes may differ depending upon the fabric treatment agent provided within the composition. For example, the fabric treatment composition can be provided as a fabric softener composition having a size of at least about 5 grams. When the fabric softener composition is provided having a size of at least about 5 grams, it is expected that it will provide fabric softening and/or antistatic properties for laundry in multiple cycles of a dryer. An exemplary size is about 30g to about 170g. It is expected that the fabric softening composition can have different sizes depending upon whether it is intended to be used in an industrial drying operation or it is intended to be used in a

consumer or residential dryer. In the case of an expected use in an industrial dryer, it is expected that the fabric softening composition will have a size of between about 150 grams and about 400 grams. When it is expected to be used in a consumer or home dryer, it is expected that the fabric softener composition will have a size of between about 30 grams and about 100 grams. A reason for a size difference between industrial use and residential use relates to the size of industrial and residential dryers. There is generally more room inside an industrial dryer to provide a larger fabric softener composition compared with a residential dryer. In the case of an industrial application, it is expected that the composition can have between about 50 cycles and about 150 cycles before replacement. In the case of residential use, it is expected that the composition can have between about 30 cycles and about 60 cycles before replacement. Although the above discussion focused on the size and the number of cycles for the fabric softener composition, it should be understood that the discussion additionally applies to the fabric treatment composition.

The fabric treatment composition includes a sufficient amount of the fabric treatment agent so that the composition releases a desired amount of the fabric treatment agent during a drying cycle to impart the desired beneficial properties to the fabric being dried. In general, it is desirable for the composition to release a sufficient amount of the fabric treatment agent to provide the desired beneficial properties and it is desirable not to release too much that could create waste or adversely affect the fabric. It is expected that the ratio of the fabric treatment component to the carrier component will vary depending upon the fabric treatment agent and the carrier component and the desired level of transfer of either or both of the fabric treatment agent and the carrier component.

In the case of a fabric treatment composition that includes a fabric softener agent, the fabric softener agent and the carrier component can be mixed together to provide a fabric softener composition that releases a desired amount of fabric softener component during the drying cycle when placed inside of a dryer. The weight ratio of the fabric softener component to the carrier component can be greater than about 1:19 and can be greater than about 1:10. The ratio of the fabric softener

component to the carrier component can be less than about 19:1, and can be less than about 10:1. An exemplary weight ratio of fabric softener component to carrier component is between about 1:19 to about 19:1. The ratio of the fabric softener component to the carrier component can be between about 1:10 and about 10:1, and can be between about 3:7 and about 9:1. It should be understood that the reference to the fabric softener component refers to the component responsible for providing fabric-softening properties, and is not meant to include the medium that may be present with the fabric softener component. That is, the fabric softener component may be commercially available in a medium that can be a solvent or a surfactant. Furthermore, the medium can be the same as or different from the carrier component. Although the above discussion focuses on the weight ratio of the fabric softener component to the carrier component, it should be understood that the same ratios can be applied to the fabric treatment component and the carrier component.

During the drying cycle, the fabric treatment composition should release a sufficient amount of the fabric treatment agent to provide a desired level of beneficial properties to the fabric. The amount of the fabric treatment agent that is released can be designed so that it depends on the fabric treatment agent and the amount of the agent needed to provide the desired beneficial properties. When it is desirable to provide UV protection and optical brightening, it is expected that about 10^{-6} to about 10^{-3} grams per pound of dry linen will be released. When it is desirable to provide fragrance to the fabric, it is expected that about 10^{-4} to about 10^{-2} grams per pound of dry laundry will be released, and when it is desired to provide softening, anti-wrinkling, color protecting and soil releasing properties, it is expected that about 10^{-3} to about 1 gram per pound of dry linen will be released.

When the fabric treatment composition is used during a drying cycle, it is expected that the amount of the composition that will transfer to the fabric will depend on the fabric treatment agent and the carrier component. In the case of non-dispensing carriers, it is expected that the amount of the composition that is transferred to the wet fabric may be the same as the amount of the fabric treatment agent that is transferred to the fabric. It should be understood that additional components may be

present in the fabric treatment composition that may transfer to the fabric. In the case of dispensing carriers, it is expected that the amount of the dispensing carrier that is transferred will depend upon the dispensing carrier selected. For example, it may be desirable to select a load dispensing carrier when the fabric treatment composition includes a fabric treatment agent that can be transferred in relatively small quantities. For example, in the case of a UV protectant, an optical brightener, or a fragrance, it may be desirable to select a carrier that provides low dispensing of the carrier. A higher dispensing carrier may be selected when it is desirable to transfer larger amounts of the fabric treatment agent. For example, when the fabric treatment agent that is dispensed includes fabric softeners, anti-wrinkling agents, color protectants, and soil releasants, it is expected that the higher dispensing carriers may be selected so that the fabric treatment composition transfers about 0.01 to about 1 gram per pound of dry linen for each cycle.

During the drying cycle, the fabric softener composition should release a sufficient amount of the fabric softener composition to provide a desired level of softening properties and, if desired, antistatic properties. In addition, the fabric softener composition should not release too much of the fabric softener component that would result in spotting of the laundry. It is expected that during the drying cycle, the fabric softener composition will lose between about 0.01 to about 1.0 gram of the fabric softener composition per pound of dry laundry. The amount of loss per drying cycle can be between about 0.02 to 0.75 gram of the fabric softener composition per pound of dry laundry, and can be between about 0.05 to 0.50 gram of fabric softener composition per pound of dry laundry. In the situation where a dryer that is rated for a 30 pound capacity is used to dry laundry, the dry weight of the laundry is typically about 15 pounds. In this situation, a block of fabric softener composition having a size of about 150 grams is expected to lose about 1.5 grams per drying cycle and provide softening for 100 cycles. It should be understood that the size of the dryer and the size of the fabric softener composition can vary for different types of dryers and drying conditions. For example, there are various sizes of dryers that are commonly used in industrial laundry facilities and in residential or consumer environments. Although the

above characterization of exemplary doses applies to fabric softener compositions, it should be understood that it additionally applies to the fabric treatment composition. In addition, it should be understood that various fabric treatment compositions may include higher or lower dosing per cycle depending upon the selected fabric treatment agent.

The fabric treatment composition can be designed to provide the user with a signal indicating when it is time to replace the composition with a new composition. For example, a hook and loop fastener can be embedded or placed underneath the composition. Once the composition is ready for replacement, the hook and loop fastener becomes exposed and laundry items become attached to the hook and loop fastener thereby signaling to the operator that it is time to replace the composition. In addition, a shiny material such as a foil can be embedded or placed underneath the composition. Once the composition is ready for replacement, shiny pieces of material may start falling off and becoming part of the dry fabric thereby signaling to the user that it is time to change the composition. In addition, a tag can be used similar to the shiny material so that the tag falls off and becomes a part of the dried fabric. The user or a subsequent handler of the dried fabric will read the tag that signals to the user that the composition should be replaced.

Applications

Although the fabric treatment composition can be used to impart certain beneficial properties to fabrics or laundered items during the drying operation in a dryer, the fabric treatment composition can be used to impart certain benefits further downstream. For example, in housekeeping areas, delivery of an anti-static agent to a dust cloth or mop may assist in the removal of dust when the cloth or mop is used. In addition, a polishing agent can be imparted to a cloth or polishing substrate to assist with polishing an article. In the vehicle care industry, water repellents and/or static control agents may be applied to substrates in a dryer to allow those substrates to impart those materials to a vehicle surface.

The fabric treatment composition can be provided with a variety of suggested shapes to help the user understand how the fabric treatment composition can be used. For example, in a situation where the fabric treatment composition is used to impart an insect repellent to fabric, the composition can be provided in the form of a bug.

Example 1

Seventeen fabric softener compositions for use in a dryer and providing antistatic and softening properties are presented in Table 1. The compositions are provided as solids exhibiting a melting point above 100°C.

Table 1: Fabric Softener Compositions

Trade Name	Chemical Name	1	2	3	4	5	6	7	8	10	11	12	13	14	15	16	17
Arosurf TA 100	Distearyl dimethyl ammonium chloride, 95%; propylene glycol, 5%	50.0	60.0	70.0	77.0	67.0	57.0	60.5	55.5	45.5	40.5	47.5	46.5			28.0	
Arosurf TA 101	Distearyl dimethyl ammonium chloride, 100%													30.0	25.0		
Acrawax C	Ethylene bistearamide	50.0	40.0	30.0	20.0		15.0	35.0	30.0	50.0	55.0	52.5	51.5	45.0	45.0	45.0	55.0
Witco Wax	Stearic monoethanolamide					30.0	25.0		10.0								
Tipinol CBS-S	Distyryl biphenyl derivative (optical brightener)				2.5	2.5	2.5	2.5	2.5	2.5	2.5						
Fresh n Clean	Fragrance				0.5	0.5	0.5	2.0	2.0	2.0	2.0						
Hamposyl M-95	Sodium myristoyl sarcosinate, 95%												2.0				
Finquat CT	Quaternium 75 (a cationic quaternary ammonium ethosulfate)													2.0	5.0	2.0	

Table 1 (continued)

Trade Name	Chemical Name	1	2	3	4	5	6	7	8	10	11	12	13	14	15	16	17
Varisoft DS-100	Dihydrogenated tallow dimethyl ammonium methyl sulfate, 70%; nonionic surfactant, 30%													23.0			
Varisoft 136-100	Dihydrogenated tallow dimethyl ammonium methyl sulfate, 70%; alcohol ethoxylate, 30%														25.0		
Varisoft 110-75%	Methyl bis-(hydrogenated tallow amidoethyl) 2-hydroxyethyl ammonium methyl sulfate, 75%; Isopropanol, 25%															25.0	45.0
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Melting Point (C)														120-125		127	125-130
Wt Loss/cycle						7.24	>26.00	6.72	8	4.74	2.13			6.57			

Preliminary dispensing rates of some of the fabric softening compositions of Table 1 were obtained and shown at the bottom of the table. In each test, the fabric softening composition is coated on a plastic carrier which is then locked into place on a dispenser adhered on the dryer fin. Average dispensing rate was obtained by weight difference after multiple standard wash and dry cycles with 30 lb. dry weight terry towels.

A desired amount of the fabric softening composition to provide fabric softening properties can be released during the drying cycle. In this example, dispensing of the product was measured by weight loss. Approximate dosage requirements for the solid fabric softener were developed based on comparisons to current liquid softeners. Current liquid softeners deliver between 75-150 ppm of softening agent per cycle. For example, a liquid laundry softener with 6% active softening agent with a dose recommendation at 2-3 oz/100 wt. (100 lb. dry weight linen in the wash machine) would deliver the following ppm active softening agent:

$$\frac{0.06\ active\ softening\ agent\ x\ (2-3\ oz)\ x\ 28.35\ g\ x\ 1{,}000{,}000}{100\ lbs\ x\ 454\ g\ /\ lbs} = 75-112\ ppm$$

For comparison, a target solid fabric softening composition with 45% active softening component and a dispensing rate of 4 grams per cycle in the dryer will deliver the following ppm active softening agent:

$$\frac{0.45\ active\ x\ (4\ grams)\ x\ 1{,}000{,}000}{30\ lbs\ x\ 454\ g\ /\ lbs} = 132\ ppm$$

Referring to Table 1, composition 10 meets these criteria.

Composition 10 was further tested by running a twenty cycle test to test for yellowing and softening. For the test, a liquid detergent containing no optical brightener was used for the wash cycles. To test for whiteness retention, eight new

white terry towels were read on the Hunter Lab Instrument prior to testing for whiteness index (WI) and yellowing index (YI). After 10, 15 and 20 cycles, towels were removed and reread on the Hunter Lab Instrument for WI and YI numbers. The results of the twenty-cycle test show the fabric softener composition had an average dose of 4.19 grams per cycle (Table 2). All of the towels after twenty cycles had a yellow-green appearance, noticeable in the large drop in WI and YI (Table 3).

Table 2: Dispensing data for dryer strip of Composition 10

Cycle #	wt. Initial	wt. Final	wt. Loss	Comments
1	74.69	70.79	3.90	Start with new strip.
2	65.59	57.59	8.00	
3	91.82	85.22	6.60	Replace with new strip.
4	85.22	79.17	6.05	
5	79.17	74.96	4.21	
6	74.96	70.73	4.23	
7	70.73	66.9	3.83	
8	66.9	62.28	4.62	
9	62.28	57.35	4.93	
10	57.35	52.98	4.37	
11	52.98	50.62	2.36	
12	50.62	47.91	2.71	
13	106.85	101.33	5.52	Replace with new strip.
14	101.33	96.78	4.55	
15	96.78	92.48	4.30	
16	92.48	89.46	3.02	
17	89.46	86.87	2.59	
18	86.87	84.59	2.28	
19	84.59	81.42	3.17	
20	74.69	72.09	2.60	Replace with new strip.
Average			4.19	

The average ppm active softening agent delivered by Composition 10 in the dryer per drying cycle can be calculated as:

$$\frac{(0.455\ x\ 0.95)\ active\ x\ (4.19\ grams)\ x\ 1{,}000{,}000}{30\ lbs\ x\ 454\ g\ /\ lbs} = 133 ppm$$

Table 3: Whiteness Retention Results

Towel ID	# of cycles	L* before	YI initial	WI initial	L* final	YI final	WI final	delta YI	delta WI	Whiteness Retention (%)
L	10	96.12	4.91	72.74	95.77	5.01	71.68	-0.1	1.06	98.54
N	10	96.12	5.87	69.28	95.52	5.60	69.13	0.27	0.15	99.78
J	15	96.58	3.26	79.57	95.28	5.92	67.55	-2.66	12.02	84.89
K	15	96.07	2.58	80.95	94.97	6.68	64.33	-4.1	16.62	79.47
I	20	97.13	3.25	80.79	94.29	8.05	58.46	-4.8	22.33	72.36
O	20	96.37	3.97	76.67	94.38	8.52	56.54	-4.55	20.13	73.75
M	20	96.18	4.79	73.26	94.13	8.63	56.23	-3.84	17.03	76.75
P	20	96.37	4.11	76.10	94.33	9.13	54.82	-5.02	21.28	72.04

Example 2

Composition 17 in Table 1 uses a fabric softener component that can be considered non-yellowing. The fabric softener component is available under the name Varisoft 110-75% and includes 75% methyl bis-(hydrogenated tallow amidoethyl)-2-hydroxyethyl ammonium methyl sulfate, and 25% isopropanol. It is believed that during the melt mixing and casting of fabric softening composition 17, most, if not all, of the isopropanol flashed off. The twenty-cycle test was repeated with composition 17. Fifteen pounds of dry terry towel were used in this test, and WI and YI readings were taken before and after twenty cycles. The average weight loss with this formulation was 0.976 grams/cycle. This calculates to be approximately 54.5 ppm of active fabric softener component per cycle.

Calculation:

$$\frac{(0.45 \times 0.75)/(0.45 \times 0.75 + 0.55)\ \textit{active softening component} \times (0.976\ \textit{grams}) \times 1{,}000{,}000}{15\ \textit{lbs} \times 454\ \textit{g / lbs}} = 54.5\ \textit{ppm}$$

Table 4: Dispensing data for Composition 17; 20 cycle test with Composition 17 used in the dryer for the drying cycles; 70 grams of a commercial liquid detergent without optical brightener used in the wash cycles

Cycle	Initial Wt.	Final Wt	Wt. Loss
1	48.85	47.71	1.14
2	54.21	52.72	1.49
3	52.72	51.20	1.52
4	51.20	50.00	1.20
5	50.00	49.02	0.98
6	49.02	47.97	1.05
7	47.97	47.06	0.91
8	71.74	70.18	1.56
9	70.18	68.67	1.51
10	94.28		
20		86.12	8.16
Average over all 20 cycles			0.976

Table 5: Whiteness retention results with the use of dryer fabric softening composition Composition 17

Towel ID	# of cycles	L* before	YI initial	WI initial	L* final	YI final	WI final	delta YI	delta WI	Whiteness Retention (%)
10	10	96.37	4.11	76.10	95.86	4.41	73.99	-0.3	2.11	97.23
15	15	97.13	3.25	80.79	95.97	3.55	77.25	-0.3	3.54	95.62
20	20	96.18	4.79	75.34	95.09	4.82	71.03	-0.03	4.31	94.28

Example 3

Additional fabric softening compositions are identified in Table 6. Composition 23 includes a non-yellowing fabric softener component available under the name Varisoft DS-110, and includes 70% methyl bis(hydrogenated tallow amidoethyl)-2-hydroxyethyl ammonium methyl sulfate, and 30% alcohol ethoxylate. The fabric softening quaternary ammonium compound was manufactured in a medium of alcohol ethoxylate.

Composition 23 was tested in a 20-cycle (wash and dry) test. Fifteen pounds of dry terry towel was used for this test. Results are shown in Tables 7 and 8. After twenty cycles, the average dispensing rate per cycle was 2.62 grams, delivering an average of 130 ppm active softening component.

Table 6: Fabric Softening Composition

		17	18	19	20	21	22	23
Trade Name	Chemical Structure							
Acrawax C	Ethylene bistearamide	55.0	40.0	40.0	50.0	52.5	51.5	51.5
Finquat CT	Quaternium 75 (a cationic quaternary ammonium ethosulfate)			5.0				
Varisoft 110 75%	Methyl bis-(hydrogenated tallow amidoethyl) 2-hydroxyethyl ammonium methyl sulfate, 75%; Isopropanol, 25%	45.0	60.0	50.0	50.0	47.5	48.5	
Abil Quat 3272	Quaternium 80			5.0				
Varisoft DS-110	Methyl bis-(hydrogenated tallow amidoethyl) 2-hydroxyethyl ammonium methyl sulfate, 70%; alcohol ethoxylate, 30%							48.5
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0
Melting Point (C)		125-130						
Wt Loss/cycle		1.04	3.99		2.83	2.22	1.82	2.62
length		8.5"	8 3/4"			8.5"	8.5"	8.5"

Table 7: Whiteness retention results with the use of dryer fabric softening composition Composition 23

cycles	delta WI	delta YI	Whiteness Retention (%)
8	1.08	0.13	98.58
15	1.42	0.04	98.24
20	4.53	0.34	93.99

Table 8: Dispensing data for Composition 23

cycle	wt	wt final	wt loss/cycle
1	95.82		
2			
3			
4		79.13	4.1725
5	70.7		
6			
7			
8		66.75	0.9875
9			3.5
10	81.84	78.93	2.91
11			
12			
13			
14			
15	78.93	69.1	1.966
16	broke		
17	64.42		
18	61.77		
19			
20		55.18	2.197
Average			2.62

Calculations

$$\frac{0.485\ softener\ component\ x\ (0.70\ active)\ x\ (2.62\ grams)\ x\ 1{,}000{,}000}{15\ lbs\ x\ 454\ g\ /\ lbs} = 130\ ppm$$

Example 4

The following example was conducted to evaluate the antistatic properties of a fabric softener composition. The antistatic properties were determined by measuring electrical charge in units of coulombs using an electrometer model 610C from Keithley Instruments. The electric charge was measured between a first cylinder having a size of 20 gallons provided within a second cylinder having a size of 31 gallons. Terry cloth towels were removed from the dryer and placed, one at a time, into the 20 gallon cylinder and the electric charge between the two cylinders was measured.

The results of this example are reported in the following tables wherein each table represents a side-by-side comparison between a drying operation in the presence of composition 23, and a second operation in the absence of a fabric softening composition. In each operation, 15 lb dry weight basis terry cloth towels were used. The results are reported in the following tables.

Table 9

	Items dried		terry towels		Items dried		terry towels		Items dried		terry towels
	Dryer time		45 mins		Dryer time		45 mins		Dryer time		45 mins
	Ambient temp		80.2		Ambient temp		79.2		Ambient temp		82.4
	Humidity		24%		Humidity		21%		Humidity		19%

	Composition 23			**No Composition**
-	1.80E-08		+	7.00E-08
-	6.00E-09		+	5.00E-08
-	6.00E-09		+	5.00E-08
-	1.40E-08		+	6.00E-08
-	1.00E-08		+	1.15E-07
-	4.00E-09		+	4.50E-08
+	2.00E-08		+	8.00E-08
+	3.00E-09		+	1.50E-07
+	2.00E-09		+	6.50E-08
+	3.00E-09		+	7.00E-08
			+	1.40E-07
			+	1.10E-07
Ave	**8.60E-09**		Ave	**8.38E-08**
SD	6.59E-09		SD	3.61E-08

% Reduction	89.73			
Wt initial	163.82			
Wt final	157.71			
difference	6.11/15 lb dry weight			

	Composition 23			**No Composition**
-	4.50E-08			8.00E-09
-	1.90E-08			1.20E-98
-	7.00E-09			1.50E-08
+	4.00E-09			1.60E-08
-	3.40E-08			2.80E-08
	1.10E-08			7.00E-09
-	1.90E-08			7.50E-08
-	1.00E-08			8.00E-08
-	6.00E-09			6.00E-08
-	4.00E-09			1.10E-07
+	2.00E-09			1.40E-07
				9.00E-08
Ave	**1.46E-08**		Ave	**5.34E-08**
SD	1.37E-08		SD	4.54E-08

% Reduction	72.60			
Wt initial	157.71			
Wt final	153.58			
difference	4.13			

	Composition 23			**No Composition**
	1.00E-07			1.20E-08
	4.60E-08			1.40E-08
	7.00E-08			3.00E-08
	2.50E-08			4.00E-08
	4.00E-08			9.00E-08
	3.80E-08			5.00E-08
	2.60E-08			1.20E-07
	1.00E-08			1.00E-07
	8.00E-09			1.60E-07
	1.20E-08			2.00E-07
	4.60E-08			1.00E-07
	2.40E-08			1.40E-07
Ave	**3.71E-08**		Ave	**8.80E-08**
SD	2.67291E-08		SD	6.03866E-08

% Reduction	57.86			
Wt initial	153.58			
Wt final	149			
difference	4.58			

Target = 1.50g / 15 lb.

Table 10

Items dried	terry towels
Dryer time	45 mins
Ambient temp	80.2
Humidity	25%

	Composition 23			No Composition
	3.00E-08			6.00E-08
	7.00E-08			1.00E-07
	1.20E-08			1.00E-07
	1.20E-08			3.00E-08
	4.60E-08			4.00E-08
	4.00E-08			1.80E-08
	3.50E-08			1.20E-07
	5.00E-08			4.40E-08
	2.40E-08			7.00E-08
	4.60E-08			8.00E-08
	8.00E-08			1.00E-07
	7.00E-08			
Ave	**4.29E-08**		Ave	**6.93E-08**
SD	2.22E-08		SD	3.36E-08

% Reduction	38.05
Wt initial	82.02
Wt final	79.91
difference	2.11 g

Items dried	terry towels
Dryer time	45 mins
Ambient temp	81.6
Humidity	25%

	Composition 23			No Composition
	2.20E-08			1.00E-08
	2.40E-08			2.20E-08
	2.00E-08			4.00E-08
	1.00E-08			5.00E-08
	8.00E-09			2.00E-08
	2.00E-09			3.40E-08
	1.20E-08			1.20E-08
	4.00E-09			1.20E-08
	1.00E-08			1.80E-08
	1.20E-08			8.50E-08
	1.00E-08			9.00E-08
				6.00E-08
Ave	**1.22E-08**		Ave	**3.78E-08**
SD	7.07E-09		SD	2.81E-08

% Reduction	67.73
Wt initial	79.91
Wt final	77.96
difference	1.95 g

Items dried	terry towels
Dryer time	45 mins
Ambient temp	79.7
Humidity	24%

	Composition 23			No Composition
	4.00E-09			2.20E-08
	4.00E-09			3.20E-08
	1.60E-08			4.40E-08
	4.00E-09			5.00E-08
	2.20E-08			3.00E-08
	1.00E-08			1.80E-08
	6.00E-09			3.00E-08
	1.20E-08			3.80E-08
	1.80E-08			3.00E-08
	1.80E-08			2.00E-08
	1.00E-08			3.00E-08
Ave	**1.13E-08**		Ave	**3.13E-08**
SD	6.4667E-09		SD	9.76822E-09

% Reduction	63.95
Wt initial	77.66
Wt final	76.90
difference	0.76 g

Table 11

Items dried	terry towels
Dryer time	45 mins
Ambient temp	77
Humidity	21%

	Composition 23			No Composition
	3.00E-07			5.80E-08
	1.00E-07			2.60E-07
	3.60E-07			2.00E-07
	1.40E-07			3.00E-07
	1.40E-07			2.50E-07
	2.40E-07			5.50E-07
	2.40E-07			3.50E-07
	2.00E-07			1.80E-07
	3.40E-07			3.20E-07
	2.50E-07			1.60E-07
	2.00E-07			2.20E-07
Ave	**2.28E-07**		Ave	**2.59E-07**
SD	8.33E-08		SD	1.26E-07

% Reduction	11.87
Wt initial	48.75
Wt final	47.04
difference	1.71 g

Items dried	terry towels
Dryer time	45 mins
Ambient temp	77.1
Humidity	21%

	Composition 23			No Composition
	2.20E-07			2.40E-07
	2.00E-07			2.60E-07
	2.40E-07			8.00E-08
	1.40E-07			1.00E-07
	1.20E-07			6.00E-07
	1.60E-07			1.00E-07
	1.40E-07			4.00E-07
	1.40E-07			1.20E-07
	2.00E-07			8.00E-08
	1.40E-07			
	8.00E-08			
Ave	**1.62E-07**		Ave	**2.20E-07**
SD	4.77E-08		SD	1.79E-07

% Reduction	26.45
Wt initial	47.04
Wt final	45.88
difference	1.16 g

Items dried	terry towels
Dryer time	45 mins
Ambient temp	77.3
Humidity	21%

	Composition 23			No Composition
	1.40E-07			1.20E-07
	3.00E-07			1.00E-07
	1.20E-07			6.00E-07
	2.20E-07			1.40E-07
	1.00E-07			1.00E-07
	1.00E-07			1.40E-07
	1.40E-07			7.00E-08
	1.80E-07			1.00E-07
	1.40E-07			4.00E-08
	2.40E-08			4.20E-07
	8.00E-08			1.20E-07
	1.00E-07			
Ave	**1.37E-07**		Ave	**1.77E-07**
SD	7.4658E-08		SD	1.71819E-07

% Reduction	22.87
Wt initial	45.88
Wt final	44.66
difference	1.22 g

Example 5

Another composition of this invention is represented by a composition identical to composition 23 except that the same active non-yellowing fabric softening quaternary ammonium component was manufactured in a medium of stearyl alcohol instead of alcohol ethoxylate. This composition provided desirable (high) melting temperature, dispensing, and softening characteristics similar to that of composition 23.

Example 6

Another quaternary ammonium component of this invention is represented by a composition identical to composition 23 except that the same active non-yellowing fabric softening quat was manufactured in a medium of behenyl alcohol instead of alcohol ethoxylate. This composition also provided desirable (high) melting temperature, dispensing, and softening characteristics similar to that of composition 23.

Examples 3, 5, and 6 illustrate that the active fabric-softening ingredient can be manufactured in a medium that fits the characteristics of a carrier component. Thus, in one embodiment of this invention, the medium can be chosen such that the manufactured fabric-softener component serves the dual purposes of the fabric softening and carrier and becomes a composition of this invention.

Example 7

Two solid blocks were prepared from a composition containing 45 wt.% bis(hyd. tallow amidoethyl)-2-hydroxyethyl ammonium methyl sulfate and 55 wt.% of a 50-50 mixture of ethylene bis-stearamide and ethylene bis-palmitamide. The first solid block was provided as a wide block containing sharp edges and the second solid block was provided as a wide block containing rounded edges. Both blocks were separately run in a 35 pound dryer for 45 minutes at 190°F. The weight of each block was measured after each cycle. The results are reported in Figure 5. The wide block having

sharp edges provided a greater average dose per load in the early cycles, and the wide block having rounded edges provided a more consistent average dose.

Example 8

A fabric softener and anti-static composition was prepared containing 70 wt.% bis(hyd. tallow amidoethyl-2-hydroxyethyl ammonium methyl sulfate and 30 wt.% of a 50-50 mixture of ethylene bis-stearamide and ethylene bis-palmitamide. Eight hotel-quality bath towels were washed in a Maytag home style washer and were dried in a Maytag home style dryer operating at between 140°F and 160°F until the towels were dry. The composition was mounted in a cradle inside the dryer and the dose per drying cycle was measured. The results of this example are reported in Figure 6.

Example 9

Softness of new bath towels was compared after drying with brand 1 dryer sheet (Bounce® from Proctor & Gamble), brand 2 dryer sheet (Downy® from Proctor & Gamble) and a block containing the composition of Example 8 provided having a size of 150 gram. The dryer was an industrial dryer operated at 190°F for 45 minutes.

The softness preference was measured as follows:

- New bath towels (terry cotton, hotel quality) from one batch; scoured four times using a high-caustic detergent to remove chemicals from production process
- Panel test with up to 30 panelists (male and female)
- Pair-wise comparisons between towels treated with block and towels treated with various other softeners (liquids or dryer sheets)
- Comparison in duplicate or triplicate to test reproducibility.

The results of this example are reported in Figure 7.

Example 10

Softness preference in percentage was measured for the dryer block of Example 8, brand 1 dryer sheet (a private label product) and brand 2 dryer sheet (Bounce® from Proctor & Gamble). New bath towels (terry cotton, hotel quality) were scoured four times using a high-caustic detergent to remove chemicals from the production process. The towels were dried in a Maytag home style dryer at a temperature of between about 140°F and about 160°F until the towels were dry.

The softness preference was derived from a panel test with 1-1 comparisons of towels treated with the dryer block or with either dryer-sheet. A value of 50% means the towel obtained an equal number of votes when compared with a towel treated with the dryer block. A value greater than 50% means the towel obtained more than 50% of the votes when compared with the towel treated with the dryer block. A value of less than 50% means the towel obtained less than 50% of the votes when compared with the towel treated with the dryer block. The results of this example are reported in Figure 8.

Example 11

Several products were tested for percent static reduction when used inside an industrial dryer operated at 190°F in 45 minutes. Brand 1 was a dryer sheet available under the name Bounce® from Proctor & Gamble. Brand 2 was a dryer sheet available under the name Downy® from Proctor & Gamble. The dryer block is identical to the dryer block tested in Example 8.

The percent static reduction was measured using the following equipment and procedure.

- 31-gal garbage can (galvanized metal)
- 23-gal garbage can (galvanized metal)
- The 24-gal container is mounted inside the 31-gal container using rubber blocks and screws making sure there is no metal connection between the two containers. In other words, the inner can is electrically insulated from the outer can.

- Keithley Solid-State Electrometer 610C

Generally, static electricity on surfaces is measured using devices that measure electrical fields at various distances from the surface. However, it is very difficult to obtain reproducible data with this method when applied to linen or fabric surfaces probably due to the rough surface of the fabric. A better, easier and more reproducible way to measure static electricity on pieces of fabric (linen, garment, etc.) is by measuring the total electrical charge accumulated on the piece of linen using a coulometer (electrometer).

The outer metal container acts as the Faraday cage, the inner container acts as the sink that collects all the static electricity of a piece of linen that is dropped into it. Thus, using crocodile clamps the inner metal container is connected to the signal input of the electrometer, whereas the outer container is connected to the ground of the shielded signal cable to lower the noise level of the measurement. The electrometer is set on a Coulomb scale (10^{-10} - 10^{-5} C) to measure static electrical charges. Before each measurement, the electrometer is zeroed. Thus, when a piece of linen is dropped into the inner container, its electrical charge will be displayed on the Coulomb scale of the electrometer. It is recommended to always remove the measured piece of fabric from the inner container, before re-zeroing the electrometer and measuring the next piece of linen.

A quantitative measurement of static-control of a fabric softener in a dryer can be obtained by comparison with a load of linen of equal fabric (cotton, polyester, poly/cotton blend, etc.) and equal size (e.g. hand towels, pillowcases, etc.) that is dried in a dryer without applying a fabric softener. After the linen has been dried, the electrical charge on each piece is measured by dropping the linen piece-by-piece into the metal container and reading the charge on the electrometer. Make sure the linen to be measured does not touch anything before touching the walls of the inner metal container (Use wooden tongues or wear rubber gloves to pick up the linen). Remove each piece of linen after measurement and re-zero the electrometer before measuring the next piece. After all pieces of linen of the dryer batch have been measured, calculate the average static electrical charge (C_{AV}) for one piece of linen.

Repeat the same measuring process with a batch of linen dried in a dryer while applying a fabric softener (dryer sheets, X-Static softener block). Lower values of electrical charge will be obtained. The measurement will randomly result in negative and positive electrical charges. Thus, for averaging disregard the polarity of the charge. Static control (reduction in static electricity, in percent) can then be compared using the following equation:

$$\text{Reduction in static electricity [\%]} = 100 \times [C_{AV,\ \text{No Softener}} - C_{AV\ \text{Softener}}] / C_{AV,\ \text{No Softener}}$$

The results of this example are reported in Figure 9.

Example 12

This example was conducted to compare the percent static reduction resulting from drying cotton towels and 50-50 poly/cotton pillowcases with the dryer block of Example 8 and a dryer sheet available under the name Bounce® from Proctor & Gamble. The results of this example are reported in Figure 10.

Example 13

This example was used to evaluate the charge on each towel removed from a dryer load and how the charge varies within one load. The dryer block tested was the same dryer block used in Example 8. The comparison was with a dryer sheet available under the name Bounce® from Proctor & Gamble. The results of this example are reported in Figure 11.

Example 14

This example was conducted to evaluate the non-yellowing performance of certain softening agents. After multiple cycles in a dryer, towels that were treated using certain softening agents retained a whiteness that was desirable and another set of towels yellowed. The results of this example are shown in Figure 12.

Example 15

Blocks (150 grams dispensable weight) were made using the following formula:

25% quat (methyl-bis(hydrogenated tallow amidoethyl)-2-hydroxyethyl ammonium methylsulfate)

5% Silicon quat (CSI-Q lube or Rewoquat SQ24)

68.5% wax (ethylene bis-stearamide/palmitamide)

1.5% proprietary fragrance

The following doses (in grams) were dispensed in the first ten cycles (12 washed bath towels in a 35-# dryer for 45 minutes at 190°F):

	Lube CSI-Q	Rewoquat SQ-24
1	3.08	3.58
2	3.05	3.66
3	3.20	3.79
4	2.44	3.61
5	2.77	3.25
6	2.90	2.53
7	2.29	1.83
8	2.56	2.82
9	1.73	1.63
10	1.71	1.70

Anti-wrinkle effects were evaluated using panel tests.

Example 16

1 prototype blocks (150 grams dispensable weight) was made using the following formula:

30% quat (methyl-bis-(hydrogenated tallow amidoethyl)-2-hydroxyethyl ammonium methylsulfate)

5% Varisoft WE-21 CP (DeGussa/Goldschmidt)

63.5% wax (ethylene bis-stearamide/palmitamide

1.5% proprietary fragrance

The following doses (in grams) were dispensed in the first 2 cycles (12 washed bath towels in a 35-# dryer for 45 minutes at 190°F):

Cycle	Dose (Grams)
1	5.64
2	5.21

The above specification, examples and data provide a complete description of the manufacture and use of the composition of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.